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Emergency drills for agricultural drought response: a case study in Guatemala

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Abstract

Drills are an important element of disaster management, helping to increase preparedness and reduce the risk of real-time failure. Yet they are not systematically applied to slow-onset disasters such as drought, which cause damage that is not immediately apparent and thus do not solicit immediate action. This case study evaluates how drills inform institutional responses to slow-onset disasters. We focus on Guatemala, a country where drought has severe impacts on livelihoods and food security of small farmers. Implementing part of the Ministry of Agriculture institutional response plan for drought, we explore how drills can help to detect issues in drought emergency response and to obtain an institutional focus on improvements in preparedness. Findings show that emergency drills alone do not trigger institutional improvement if unsupported by a wider strategy aiming at improvement of protocols and capacities. They are valuable, however, in making problems transparent and in creating space for discussion.

Keywords

Cyclical drought – emergency drill – institutional capacity – slow-onset disasters – climate adaptation

Funding declaration

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1. Introduction

Drought is given a much lower priority in disaster management than other types of disaster (Wilhite 2005). The particular nature of drought-induced emergencies makes them difficult to manage. Compared to abrupt emergencies such as floods, typhoons, earthquakes or volcano eruptions, drought has a slow onset and is less visible to the public eye. Drought can be reasonably well predicted in many areas of the world; however, the precise moment when a dry period becomes an emergency is difficult to determine objectively in real time. When a drought starts, its effects on human wellbeing and the environment are not immediately clear.

Drought can cause substantial damage over large areas, but causes little damage to easily observable assets, such as public infrastructure or homesteads. Instead, drought damage consists largely in losses to harvests and livestock that are difficult to quantify without detailed studies. Knock-on effects on food availability tend to become acute only some months after the actual drought begins. The ambiguous and slow nature of drought often precludes a brisk and decisive emergency response and hinders the development of proactive drought management (Wilhite et al. 2014). Worse, often when the extent of the drought has become clear and decision-makers start to panic, it starts raining. The emergency quickly loses its political urgency and decision-makers retreat into apathy. This vicious circle hinders the development of a resilient farming sector and increases vulnerability to future droughts (Wilhite et al. 2014). Droughts become a disaster to society only when there are no mechanisms in place for response, coping and mitigation. Early intervention is decisive to avoid an emergency, which can be managed with available resources, becoming a disaster, where the impact may be beyond the capacities of the institutions operating in the affected area. In many drought-prone regions, projections foresee an increase in droughts (Wilhite et al. 2014). This underlines the importance of devoting greater attention to drought management.

The shift — from reactive crisis response to proactive risk management — requires several changes, including the development of institutional capacity and the provision of timely information to key decision makers (WMO and GWP 2014). It is crucial to create learning opportunities for organizations working in drought response and a sound situation assessment in order to target interventions to reduce the impacts of drought (Hedlund, 2007).

An important approach to evaluate and improve the organizational capacity of a public institution to respond to an emergency is the use of a *drill* or a *simulation*[1] (Lee et al. 2009). Drills are a

[1] In this paper, we will use the term “drill” to denote the type of simulation carried out in real-time and involving physical aspects of the real-world emergency response.

compulsory part of many emergency response strategies. They can be used to evaluate the preparedness of a hospital to tackle a catastrophic accident with many casualties or in schools to train staff and students in the case of an earthquake or fire (Lee et al., 2009). In drought management, however, drills have not been used extensively.

The objective of this study is to evaluate how emergency drills can inform institutional responses to slow-onset disasters such as droughts. To this end, we organized two emergency drills in Guatemala, each implementing a different step of the existing institutional drought response protocol. This case study explores how drills can help to detect issues in drought emergency response and to obtain an institutional focus on possible improvements in preparedness.

2. Background

2.1 Building institutional capacity in drought management using simulations and drills

In many regions of the world, climate projections foresee an increase in the frequency and severity of droughts (Wilhite et al. 2014). This underlines the importance of devoting greater attention to building institutional capacity for proactive drought management. Drills offer a way to do this because both individual and institutional learning in disaster management benefit from simulations and games (Hofstede et al. 2010, Crookall 2010).

With drills, an organization can avoid trial-and-error learning during the actual emergency, which usually comes at a high economic cost and can lead to irreversible damage or even loss of human life (Nathan and Kovoor-Misra 2002). Drills serve to detect potential failings of communication and coordination and provide opportunities for improvement in emergency response protocols. Drills produce a sense of ownership and shared focus, unlike a paper protocol. One of the strength of drills and simulations is that they allow one to evaluate the capacity and knowledge of individuals and organizations and also their ability to act collaboratively (Hofstede et al. 2010).

One endemic issue in emergency response is the learning action gap: knowing about what is good and effective in emergency response does not necessarily result in individual or organizational behavior change. This gap is a product of the incentive environment that shapes individual and organizational behavior (Pelling 2007).

Simulations aim at closing the learning action gap, linking tacit and formal knowledge through action and experience (Duke, 2004). Having said this, simulation exercises need to follow a certain structure in order to ensure that the experience translates into a proper learning process (Crookall 2010, Hofstede et al. 2010). Simulations or drills are not only about playing in a safe setting: they start with a careful design process, including participatory elements, which lays the basis for the event. The drill itself includes participants and also observers and it ends with a thorough debriefing process to ensure that the experience translates into a learning process (Crookall 2010, Hofstede et al. 2010). Debriefing and reflection are at the core of the experiential learning process (Kim 2014).

Simulations and drills as a tool to inform institutional emergency response have been studied in different fields of disaster risk management. If properly designed and debriefed, multi-agency exercises or simulations can create mechanisms for learning (Andersson 2016). This includes going beyond the focus on action and requires participants to invest valuable time in debriefing and

discussion after the event. In this way, drills create a space for making explicit prior knowledge and to critically reflect on it.

A study using drills to test intra-organizational emergency preparedness in the transportation sector found that the role of external observer is particularly important (Yoon et al. 2008). The studied drills were an effective tool for improving performance during emergencies. They allowed the evaluation of institutional capabilities at low cost and facilitated observation of institutional and individual emergency responses and reflection on the strengths and weaknesses of the organization.

Bharosa et al. (2010) used observations during an emergency drill and survey data after the drill to understand how actors of different institutions share and exchange information during a simulated emergency. Observations during the drill allowed them to obtain detailed insights into the complexities of multi-agency emergency response, which would not have been possible using only survey data gathered after the drill. Analyzing the use of simulations in UK disaster response, Kim (2014) suggests that the simulation exercises can inform the adaptation of plans, skills and manuals, assuring the degree of institutional flexibility necessary for targeted disaster response. As Bharosa et al. (2010) observe, the strength of emergency drills is that they afford direct observation of real-time behavior.

Drills for drought management, however, are virtually non-existent. For drought management in the US context, Mason and Verner (2008) describe "tabletop" exercises, in which participants respond to drought in a simulation that takes them through an accelerated unrolling of events. These exercises were found especially helpful to explore and address inter-institutional communication, coordination and planning. Hill et al. (2014) use simulation games where they present different crisis management tools to observe decision-makers' behavior in a simulated emergency. However, these exercises are not drills.

Even though drought is a slow-onset event and institutional responses are often indecisive, when individual responses are needed, they tend to be executed under high time pressure. Once past a tipping point, a drought represents a serious threat to agriculture, food security and human life and requires immediate attention. When a state of alert or emergency has been officially declared, the priorities are to provide credible data on the extent of damage and loss, and a swift response. Real-time drills could offer a distinctive contribution to drought management that has not been properly investigated.

2.2 Drought in Guatemala

Guatemala is a drought-prone country (Wilhite 2005). It is characterized by a high incidence of poverty and food insecurity, with a social system that is highly unequal in economic opportunities and weak public institutions. The country has to deal with multiple social and environmental conflicts (World Bank 2009, IFPRI Global Hunger Index 2016[2], UNDP, n.d.). Guatemala's agricultural sector has a large proportion of small-scale subsistence agriculture and livestock production with low levels of technological sophistication (FAO 2014).

Guatemala's climate is divided into a dry season (November to April) and a rainy season (May to October) with some variation in timing between regions and years. In our study area, Chiquimula,

[2] see http://ghi.ifpri.org/

average rainfall ranges from 600 to 1200 mm per year in different municipalities. The distribution of rainfall is bimodal: two peaks of rainfall occur, separated by a dry spell called *canícula* that normally occurs between June and August (GWP 2014). Drought, in this climate, refers mainly to the variation in the duration of this dry spell. The length of the *canícula* does not necessarily affect the average annual precipitation and the water recharging of the region. However, this dry spell occurs when the main food crops are still growing and it becomes a hazard to agriculture and food security if its duration extends beyond what is expected from historical patterns and experience. Variations in the start, duration and end of this dry spell challenge small farmers' planning decisions about when to plant their basic staple food crops, maize and beans (GWP 2014). The prolonged dry period is cyclical in nature and is highly related to the El Niño phase of the ENSO cycle (ACF et al. 2012).

Cyclical drought thus poses a serious threat to the livelihood strategies and food security of the farmers as they lack strong coping mechanisms as a result of poverty and lack of specific knowledge (ACF et al. 2012).

In 2015, an estimated 1.3 million people in Guatemala were affected by an unusual drought with 720,000 in immediate need of food assistance (UN-OCHA 2015). In spite of this, the Guatemalan Ministry of Agriculture, Livestock and Food (MAGA) did not issue any official information of damages and losses in basic grain production and the government of Guatemala did not declare an official emergency (ACF 2015b). Key informants from the non-governmental sector claimed that the institutional response from government bodies was insufficient, uncoordinated and inefficient. Then, with the first rains, the situation in Guatemala eased and public actors diverted their attention to other urgent needs. This behavior is known as the "hydro-illogical cycle": as soon as it starts raining, the emergency loses its potential urgency and decision makers fall back into apathy (Wilhite 2012).

After a strong El Niño in 2016, a recent forecast again predicts a high probability for El Niño for the second half of 2017.[3] In the next few decades, forecasts suggest that climate change will intensify droughts induced by the El Niño phase of the ENSO cycle (Imbach et al. 2010). Guatemala is the country with the largest area affected by the cyclical droughts in Central America (ACF et al. 2012) and is among the global water and security hotspots in 2016, where the effects of the 2015 drought, violence, weak economy and government failure may cause social tension and increase migration (LaFond 2016). These events present a serious risk to small farmers' agricultural production, their livelihoods and the food security of a great part of rural families in the region (Imbach et al. 2017). These factors indicate the urgent need for the country to develop a sound climate risk management strategy. For example, early interventions (such as changes in the sowing period) or early responses (for example targeted food aid), can mitigate the impact of drought.

2.3 Institutional context for drought response in Guatemala

Effective drought management policies aim at decreasing the vulnerability to and impact of drought and are in place and operational before the full extent of the severity of the event is known. In

[3] See http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf, checked 28/04/2017

Guatemala, public institutions together with non-governmental aid agencies are increasingly working towards a more integrated drought risk management approach (CONRED 2015).

In order to address the risk of an agricultural drought to the production system and rural food security, MAGA developed an Institutional Response Plan (abbreviated in Spanish as PIR). The objective of the PIR is to reduce the impact of drought on human life, crops and agricultural infrastructure (MAGA 2012). In case of an abnormally long period without rain, the plan defines a series of actions and protocols of institutional steps to be followed in order to evaluate the situation in the agricultural sector and to inform decision-makers. The protocols establish communication flows and the chain of command between the different decision-making levels in MAGA.

Based on the information that is generated through the process, authorities decide whether to declare an emergency. Declaring an emergency allows the liberation of national and international emergency funds to respond to the drought in order to ensure food security. The successful implementation of the protocols of the PIR is critical for a proactive drought management strategy as the information gathered in the field is decisive in order to act and react in time.

The PIR is embedded within the national legislation on disaster prevention and reduction, which spans several ministries and national institutions, and responds to the National Response Plan (abbreviated in Spanish as PNR). CONRED, the national coordination entity for disaster reduction, is responsible for the implementation of the PNR and coordinates public and private institutions, civil society and international donors for disaster response and prevention in Guatemala (CONRED 2011). CONRED has recently started to work on plans for drought response and damage prevention (CONRED 2015). This is an important step towards integrating a slow-onset disaster into an integrated risk management framework.

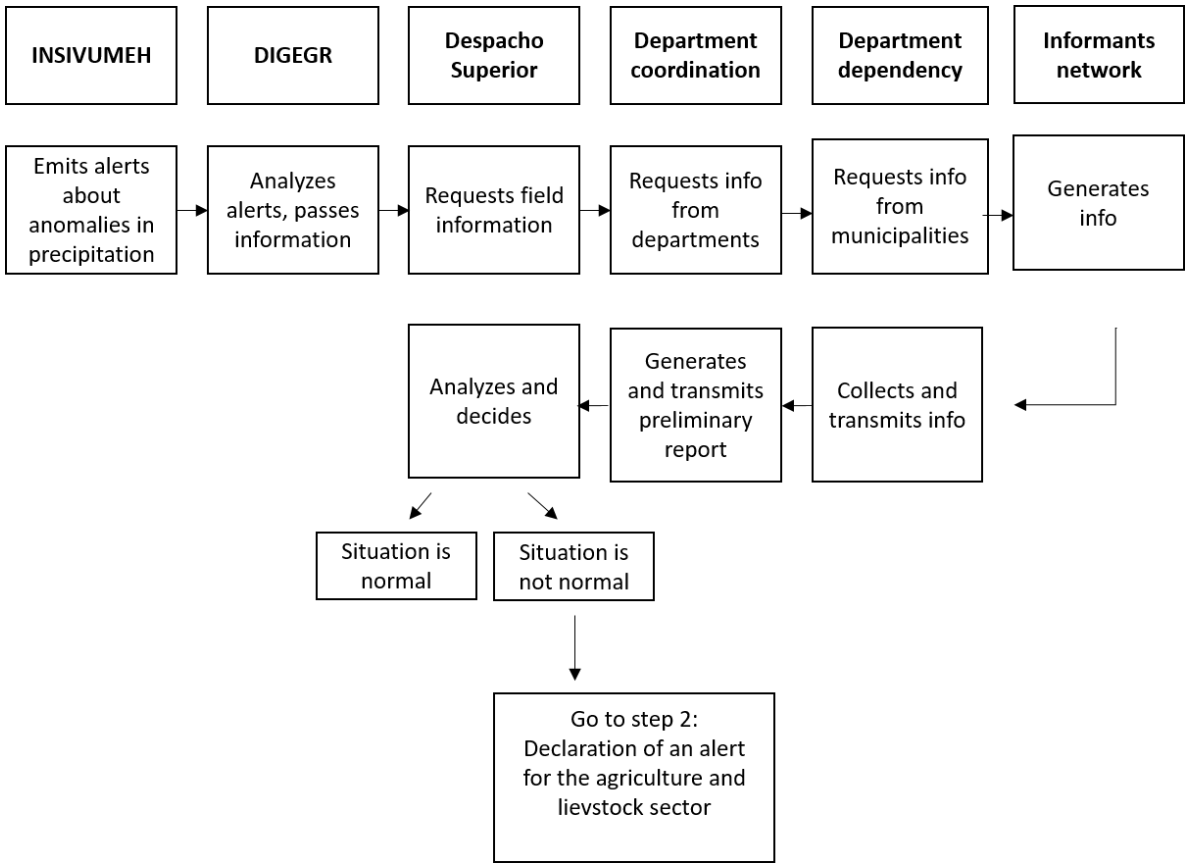

Figure 1. Step 1 of the MAGA PIR: Monitoring of the situation in the field. Simplified overview, adapted from MAGA (2012). (Legend: INSIVUMEH (National Meteorological Institute), DIGEGR (Unit for geographic information and risk management), Despacho Superior (Ministerial central decision-making unit)

The response protocol in case of droughts follows five steps: (1) Monitoring of the situation in the field, (2) Declaration of an alert, (3) Declaration of an emergency, (4) Actions during the drought, and (5) Actions after the drought. All five steps follow the same chain of command as presented in Figure 2. After every step, the central decision-making unit (Minister and Vice-Ministers) decides whether to continue with the next step in the protocol, based on the information gathered at the local level.

We evaluated Steps 1 and 2 of the PIR's drought protocol. Step 1, "Monitoring of the situation in the field" consists of a preliminary monitoring of losses and damage in the agriculture and livestock sector of the affected region after experiencing a prolonged period of no rain. This information is used by the central decision-making unit, the *Despacho Superior* (Office of the Minister), to decide whether the situation is normal or not. In the case of an abnormal situation, step 2 of the response protocol, the declaration of an alert due to severe drought conditions, applies.

Step 1 of the protocol starts when the National Meteorological Institute (INSIVUMEH) provides information about abnormally low precipitation. The unit for geographic information and risk management (DIGEGR) passes this alert to the *Despacho Superior.* Based on this information, the

central decision-making unit decides whether to request more detailed information from the department coordination unit. This unit passes the information request to the head of the department units in the affected region. The head of the department unit sends out its extension agents to evaluate the situation in the field by contacting an established network of farmers. The report based on field evaluation goes back following the same chain of command until it reaches the central decision-making unit (see Figure 2 and MAGA 2012). Based on the field report, the central decision-making unit decides whether the situation is normal or not. If MAGA declares the situation to be abnormal, step 2 of the protocol applies.

In Step 2 the *Despacho Superior* requests more detailed information about damages and losses in the affected regions. This request is passed through the department coordination and department dependencies to the informant networks. Extension agents gather the detailed information in the field. The information goes back to the *Despacho Superior* through the same nodes (see Figure 2). At the end of step 2, and based on the field data the main decision is made, whether to declare an emergency for the agriculture and livestock sector. If yes, then step 3 of the protocol follows.

As outlined above, the slow-onset character of a drought makes it difficult for decision-makers to decide on emergency status and interventions. The PIR represents the institutional guide to cope with the challenges that drought poses.

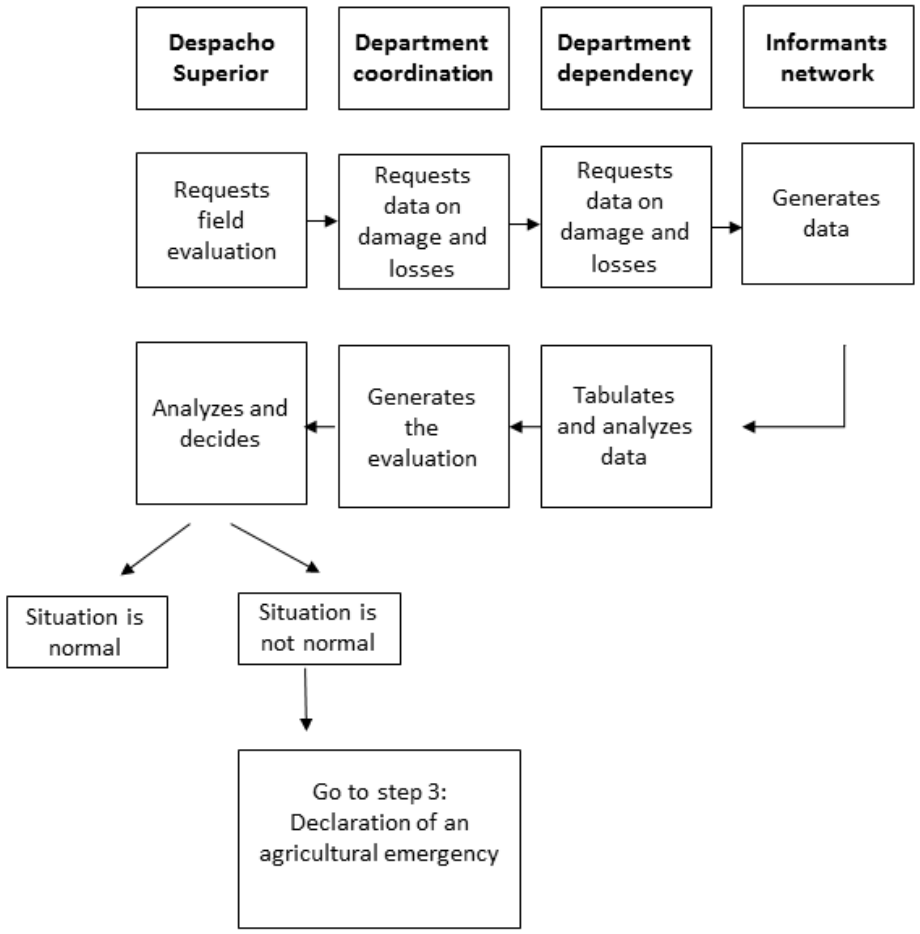

Figure 2. Step 2 of the MAGA PIR: Declaration of an agricultural emergency. Simplified overview adapted from MAGA (2012)

2.4 Study area

The study region forms part of the Central American dry corridor. The emergency drills were conducted in collaboration with the MAGA department dependency of Chiquimula (see Figure 3). Chiquimula and the Guatemalan dry corridor have been hit by four unusually extreme drought periods in the past six years (ACF 2015a).

The study region is characterized by small-scale subsistence-based staple food production, a high rural poverty rate and high vulnerability to food insecurity among the rural population (FEWSNET et al. 2007). The poorest sector of the rural population is not able to sustain their families throughout the year and depends on income as agricultural day laborers. Temporary migration into other regions in Guatemala, Honduras and El Salvador has been an integral part of the livelihood strategy of farm households in Chiquimula. In recent years, however, a severe coffee rust epidemic in the region has considerably reduced opportunities for seasonal work, with adverse effects on food security and vulnerability to droughts (ACF 2015a; Avelino et al. 2015).

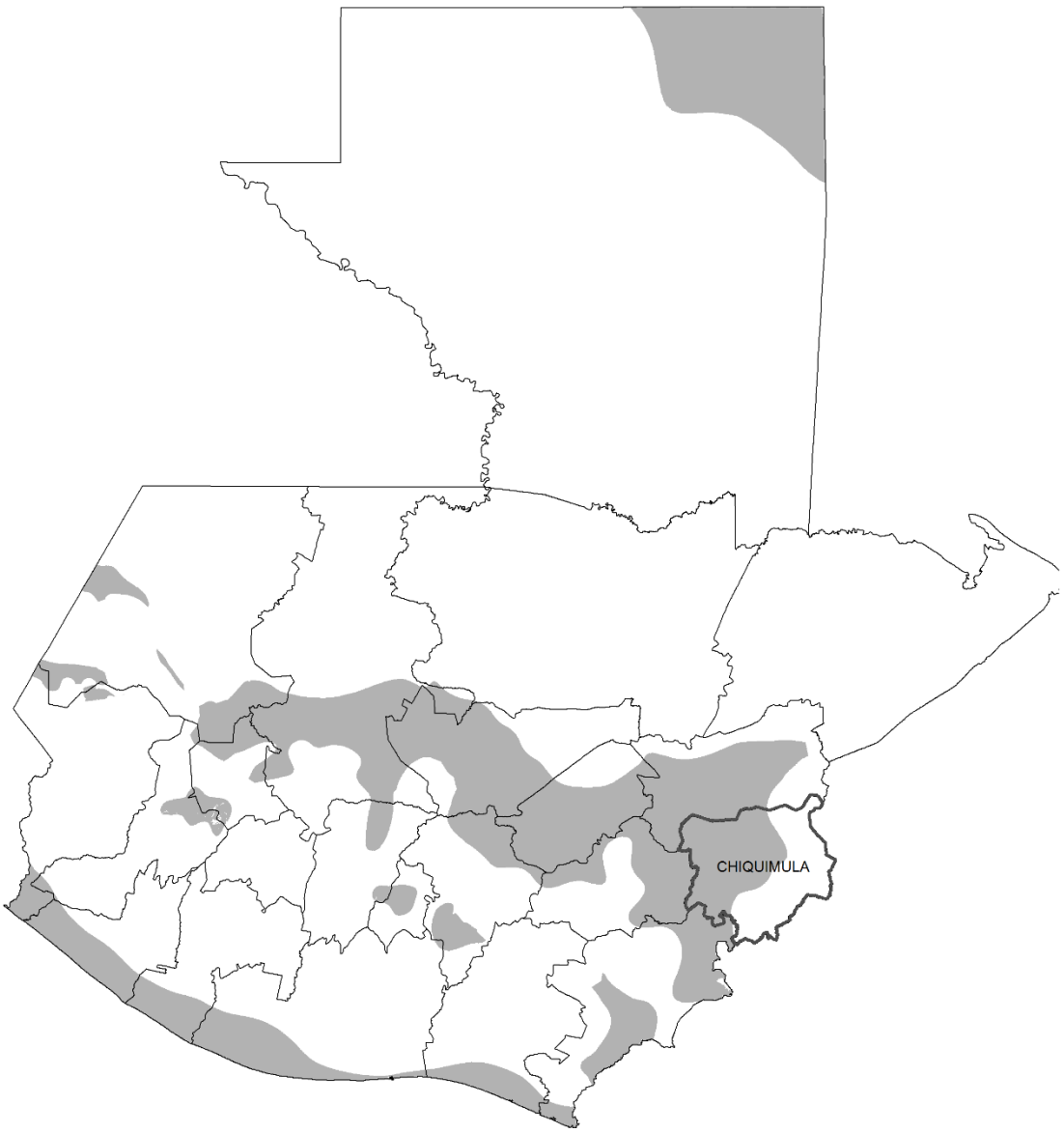

Figure 3. Drought-prone zones and study region in Guatemala (Source: IARNA 2009, http://www.infoiarna.org.gt/index.php/component/docman/cat_view/162-galeria-de-mapas?start=10)

3. Methodology

3.1 Drill design

Two drought emergency drills were executed in various municipalities in the department of Chiquimula, one in 2014, the other in 2015. The drills were prepared in meetings involving experts from the MAGA, CONRED, Action Against Hunger (ACF, an international NGO), Tropical Agricultural Research and Higher Education Center (CATIE, a Latin American research center) and Bioversity International, an international research organization.

The first emergency drill, held in 2014, is a simulation of Step 1 of the PIR, monitoring of the precipitation and situation on the ground. The second drill, held in 2015, is a simulation of Step 2 of the PIR, declaration of an alert due to an agricultural drought. In both steps, a field evaluation took place, both of which were organized in the same way. The emergency drill was partial, focusing on the communication between department dependency and the extension agents and the damage evaluation in the field. The part involving ministerial decisions was omitted.

Two groups of people participated in the drill. The first group consisted of MAGA technical staff at all levels of the command and information chain, including staff from the headquarters of the ministry, the regional dependency and agricultural extension agents employed by the Ministry. The second group was composed of observers and evaluators who accompanied the extension agents during the field evaluation in groups of two; representatives of the other participating organizations took up this role.

Both drills lasted one and a half days, one day for the execution of the emergency drill in the field and a half day for the evaluation of the drill and its results with participants and key stakeholders.

Preparations for the drill involved creating a simulated damaged plot for the extension agents to evaluate. We invited a number of farmers to function as informants in the drill. We purposely selected farmers based on the characteristics of their farms, which needed to have relatively good access and be cultivated with maize or beans, the main staple crops in the area. In the first drill, farmers were beneficiaries of projects led by ACF. In the second drill, farmers that were members of MAGA's extension network were selected. In 2014, the drill covered three municipalities, with three farmers as key informants in each municipality. In 2015, the drill covered six municipalities, with 2-3 key informants in each municipality. To simulate the crop damage on the farms, every external group evaluator received a poster with pictures of two different degrees of damage to plants and a reference picture of non-damaged plants. Different colored tape represented the different types of damage: black indicated damage of the grain and red indicated damage in the development of the plant. The colored tapes were placed randomly on a certain number of plants in order to simulate different degrees of damaged crops in the fields that were visited by the extension agents.

We held a preparatory meeting for all technical personnel involved at the local level before the actual drill. All persons involved in the drill at different institutional levels were briefed beforehand. The extension agents were told to act within their actual professional role. For evaluating production damage and losses, the extension agents interviewed the selected informants, visited plots with simulated damage and talked to community leaders. To gather the data, official MAGA procedures

and forms were used. Every participant received a folder with the instructions and the timetable of the drill.

3.2 Research approach

We used a combination of data gathered through participatory observation during the drill and self-assessment by the participants to evaluate the results of the drill after the event. The combination of observation and self-assessment made the exercise more transparent. Using only self-assessment would have been less reliable (Kobes et al. 2010). Participatory observation allows us to understand how people behave during the event and is a practical method to collect data during the operation (Bharosa et al. 2010). Groups of observers and extension agents indicated the advantages and disadvantages of the drill and the protocol, as well as the strengths and weaknesses of the gathered results. Based on their field experience, participants also elaborated recommendations for decision-makers within MAGA.

We made detailed notes on our observations about the extension agents' behavior and actions during the drill. Observations on other groups were shared by observers from the other participating organizations, which were recorded during the evaluation meeting at the end of the exercise.

We analyzed the observational and self-assessment data using a qualitative data analysis approach including different steps (see Lecompte 2000). We cleaned the data to prepare it for analysis. We structured and ordered the data to find groups of items in the observations and self-assessment. In this way we were able to group data and observations for further interpretation.

3.3 Drill execution

In both drills, we followed the same methodology and the communication flows identified by the PIR do not differ significantly between step 1 and 2 (see figures 2 and 3). Table 1 gives the reader an idea about the course of the first drill to exemplify the event.

The drills started with the request from the coordination unit of the central offices of MAGA to provide information about damage and losses in basic grain production due to an extended drought. During the drills, all instructions from the higher hierarchical level were clear about the nature of the exercise. During the drills, the MAGA department coordination unit was in constant contact with the extension agents in the field via email and cell phone to communicate instructions. Both drills finished with the successful submission of a situation report of damage and losses in grain production from MAGA extension agents to their superior.

The first drill included 20 participants: 6 extension agents, who operated in groups of two, 9 external observers and 5 people from the organizing committee. Three external observers remained in the coordination unit and 6 observers accompanied each of the three groups of extension agents. The second drill included 27 extension agents and 14 external observers. Two observers remained in the MAGA dependency to observe the coordination of the drill. The other observers accompanied the 6 groups of extension agents to the field.

Table 1. Communication flow during the drill. Protocol based on first drill exercise.

Day 1	
9:05 am	Drill starts
9:35 am	**From MAGA central level to MAGA department dependency Chiquimula** Request for a report about the impact of the drought on agricultural crops in the area via email. Instructions to organize the working groups and to pay attention to further instructions that will be sent via email. The message starts and ends with the declaration *"This is a drill!"*.
10:05 am	**From MAGA central level to MAGA dependency Chiquimula** Instructions about the three communities selected for evaluation throughout the drill are sent via email. The message starts and ends with the declaration *"This is a drill!"*
10:15 am	Extension agents and external observers depart for the field evaluation.
11:00 am	**From MAGA central level to MAGA dependency Chiquimula** Email with information about the community leaders that extension agents should contact in order to collect information about damage and losses due to the drought. The message starts and ends with the declaration *"This is a drill!"*.
11:25 am	**From extension agents to department dependency Chiquimula** One group of extension agents informs that they were unable to contact the leader of the community they are supposed to visit. Cell phone coverage in the corresponding community is very weak.
1:55 pm	**Department dependency Chiquimula to extension agents** One group of extension agents has not yet reached the corresponding community. Department-level representative is trying to make phone contact with the group, which is not successful.
2:20 pm	**Department dependency Chiquimula to extension agents** Department representative is managing to communicate with the group. The group informs that they were assuming they should visit a community of their choice. The group states not having received the email with the instructions on which communities they should visit throughout the drill. The group is advised to go to the initially selected community.
2:30 pm	**Department dependency to extension agents** Extension agents must send a preliminary report until 5.30 pm. The email starts and ends with the declaration *"This is a drill!"*
4:10 pm	**Department dependency to extension agents** Extension agents receive email that confirms 5.30 pm as the submission deadline for the preliminary report. The message starts and ends with the declaration *"This is a drill!"*
5.30 pm	**Department dependency to extension agents** Email to the extension agents to confirm the submission of all reports. The next day, 8am, the extension agents will receive further instructions on how to proceed with the evaluation. The message starts and ends with the declaration *"This is a drill!"*
Day 2	
8:00 am	**Department dependency to MAGA central level** Email informing that the field phase of the information collection process has finished. The extension agents have to submit their information for the presentation of the final report by 12 noon. The message starts and ends with the declaration *"This is a drill!"*
8:45 am	**MAGA central level to department dependency** Email to inform the reception of the final report. With the information received, the drill is officially over. The message starts and ends with the declaration *"This is a drill!"*

4. Results

4.1 Participatory evaluation of the drills

In a participatory group exercise, extension agents and external observers and evaluators discussed the strength and weaknesses of the implementation of the PIR in the drill and suggested recommendations. We analyzed the results of both drills together, as strength, weaknesses and recommendations identified by the participants can be subsumed under the same topics.

Strengths identified by participants:

- **Extension system:** the extension system with motivated field staff who work with an extensive network of farmers in a relationship of mutual trust was considered an important prerequisite for the successful implementation of the protocols. Participants felt that the relationship of trust with farmers makes the information more reliable as they are more willing to participate.
- **Instructions of PIR:** Participants stated that the PIR clearly defines the chain of command and information flows between the different hierarchical levels of MAGA which helps the implementation.
- **Inter-institutional coordination:** a well-functioning coordination among institutions at the local level was identified as essential for the successful implementation of the protocols.

Weaknesses identified by the participants:

- **Lack of knowledge and experience with the PIR:** One reason participants identified for feeble knowledge about the PIR and lack of experience in its implementation was the high turnover of technical staff within MAGA. Communication channels within the MAGA structure are weak and decisions made at the central level do not necessarily reach the dependencies.
- **Unrepresentative data**: Although there is an existing survey instrument for data collection for damage and loss evaluation, extension agents stated that they were not trained in its use. In the field, they were using their individual methods. Extension agents clean and manipulate the data gathered in the field before they send them to the central agency. Participants felt that this could influence the decisions made at the central level (politicization of the data). The number of communities, plots and farmers visited during the drill was very small and the participants questioned the representativeness of the damage evaluation during the drill.
- **Poor access to supporting infrastructure:** The participants felt that they have poor access to supporting infrastructure, which impedes good implementation of the protocols. They stated that they lack access to official meteorological data and supporting information, such as maps or georeferenced data. MAGA does not have enough vehicles to mobilize extension agents in the event of an emergency and many MAGA dependencies lack a well-functioning IT infrastructure.
- **High staff rotation and institutional ties based on personnel relationships:** Although good interinstitutional coordination in Chiquimula was mentioned as a strength, the participants claimed that contacts between institutions and organizations depend mainly on personal contacts of the technical staff. Inter-sectoral communication in an emergency is not

institutionalized and not mentioned in the PIR. Changes in staff thus directly affect the coordination of the local institutions in the case of an emergency. Paternalistic structures and frequent changes in personnel and programs at all levels of the public administration were seen as threats to MAGA's effort to improve the response to extreme drought events and to institutional capacity building.

- **Raising false expectations among farmers:** participants were worried that the implementation of the protocols were raising high expectations among the farmers who were visited during the drill. Visiting farmers to evaluate damage on their farms raises expectations about help, especially as the drill was implemented during an actual drought period. However, the decision on measures to mitigate drought impacts was not part of the drill. In the case of a real emergency, it is not in the power of the extension agents to decide on mitigation measures. This places extension agents in a difficult position vis-à-vis the farmers they are visiting.[4]
- **Poor institutional preparation: E**xtension agents raised their concerns about feeling in general unprepared regarding the threats of agro-climatic events and they expressed doubts about institutional preparedness.
- **Missing communication flow:** The extension agents complained that the information about the results of the damage evaluation does not flow back from the central level to them. It seemed to them that they are sending the information into a black hole. This is demotivating the extension agents, as they never receive feedback on whether their efforts to collect information have been useful and whether the information has actually been used by decision-makers. The information gathered also has direct value for their work in the field
- **Infrastructure:** Additionally, extension agents complained that road infrastructure is poor which makes it difficult to reach remote villages. Cell phone coverage is poor in remote villages.

Recommendations:

Based on the strength-weakness analysis, the participants identified several strategic activities for better implementation of the PIR.

- **Initiate institutional capacity building:** participants saw opportunities to improve the decision-making and information management capacity of MAGA through the drill by implementing drills on a regular basis and also in other regions, thus initiating a process of institutional learning. Participants stated that MAGA should provide capacity building to improve the knowledge of its technical staff about the PIR and the implementation protocol.
- **Define institutional evaluation method:** The homogenization of the use of the instruments used to evaluate damage and loss in the field (indicators and quantitative procedures for estimated yield calculation, plant and yield loss, etc.) would lead to more consistent and comparable estimates of the severity of the drought.
- **Create supporting infrastructure:** Mapping the most drought-vulnerable zones in Chiquimula would make logistics easier during an emergency, and could help to draw a representative sample. Participants stated the need for more meteorological weather

[4] Thanks to an anonymous referee for pointing this out.

stations in the area to improve MAGA's access to additional and reliable information on local agro-climatic conditions.

- **Provide capacity building to farmers:** participants stated that improving farmers' knowledge of agro-climatic aspects could improve the information they provide to the extension agents.
- **Improve interinstitutional cooperation:** Collaboration between institutions depends strongly on personal contacts. Thus, participants saw an opportunity for improving the implementation of the PIR by officially incorporating other local institutions in MAGA's disaster response plan. They developed the idea of a local drought entity that could coordinate this effort.

4.2 Participatory observations of both drills

The participants of the second drill were not informed about the results and recommendations of the first drill. In both drills, we observed that staff responsible for coordination in MAGA did not dedicate much time to organizing and coordinating before and during the drill. We felt a general lack of institutional commitment. This affected the course of the event. Contrary to extension agents, we observed missing instructions on how to do the damage and loss evaluation, communication problems and missing assignment of responsibilities.

In the first drill, the information on the selected communities and farmers came to the organizers after the extension agents had already left for the field. The regional office tried to communicate the change in location to the extension agents, but this proved difficult due to the lack of coverage of the mobile network in the area. In one case, it took several hours to notify the extension agents. This inadvertently provided an opportunity to observe the challenges to communications. In the second drill, the selected farmers were not informed beforehand.

In both drills, the field visits started late and took longer than expected, and the execution of the drill was affected by poor cell phone coverage. This had effects on communication between the coordinators and the extension agents. During the first drill, for example, it was very difficult to inform agents of the selected farmers to be visited once the agents had left MAGA.

We observed in both events that extension agents did not apply a standardized instrument and method to evaluate the damage in the field, although all extension agents were advised to use the same official MAGA survey instrument. It seemed like every extension agent had his own way of collecting information and coming up with a monetary estimate of drought loss and damages. Extension agents asked a wide range of questions about agricultural production, including about the losses that other community members had experienced and the general situation of the household. They recorded this information on the back of the form. After the exercise, the extension agents prepared a report that included some details of the calculations and a number of photographs.

In the second drill, extension agents included an estimation of the losses due to pests, pointing out the presence of white grubs (larvae of *Phyllophaga spp.*). The total loss estimated included the losses due to low germination, white grubs, and the simulated drought.

In the second drill, we observed farmers' influence on extension agents' damage and loss evaluations. Farmers felt that they would receive more help if they reported higher crop damage. We also observed that after the field observations had concluded, MAGA representatives were

actively correcting and influencing the results of the extension agents' field observations about crop damage and losses. Hierarchical rank and seniority in MAGA played an important role in influencing the results, with a senior person overruling extension agents' judgment.

All extension agents involved in the drills were male, even though MAGA employs many female extension agents. The extension agents addressed the male head of household to obtain information. This is logical from the perspective of the information required, which focuses mainly on production losses in the staple crops. But this might give an incomplete picture of the impact of drought as women usually have their own domain within the farm household, for example poultry or a kitchen garden. Although this does not change the official information on basic grains, it helps to get a clearer picture of how serious the drought is in relation to food security.

5. Discussion

This was the first time MAGA Chiquimula was implementing the PIR for drought emergencies. The institutions and participants had no previous experience upon which to build. The drill allowed us to identify four main findings.

First, the drill revealed a wide range of institutional issues and problems in implementing the PIR. The PIR is clear on hierarchical relations (see Figures 2 and 3) but the protocol lacks specifications on horizontal coordination and communication mechanisms and on inter-institutional interaction at the local level between MAGA and other institutions important for the drought response. The protocol lacks indications about how the information is transferred back to the local level once evaluated by the central decision makers.

The drills revealed deficiencies in training of MAGA staff in the procedures of the PIR. There is little transparency and regulation of the process that leads to the regional-level report. The PIR does not provide a standardized format to gather information in the field. Although MAGA has an institutional form to collect damage and loss data, extension agents have not been trained in its use and there is no homogeneous approach in place for damage evaluation; the result is thus influenced by personal opinion. This leads to problems in the quality and reliability of the data and makes precise and target-oriented decision-making more difficult at all decision levels. The lack of standardization, harmonization of processes and division of tasks are considered important hindering factors of effective communication during disaster response (Bharosa et al. 2010).

It is clear that the lack of standardization in the use of survey instruments resulted in visible problems in subsequent phases of the execution of the PIR. In one case after the 2014 drought, a MAGA departmental office reported that more families were affected by drought than the total number of families living in that area according to the official census! This is an obvious error that likely reflects political interference in reporting (personal comment, MAGA civil servant). Even though these types of issues are corrected to the extent possible at the central level, this example makes it clear that issues around data collection and transmission, as well as external influences, have far-reaching consequences on data accuracy.

Second, the drill facilitated the meeting of different institutions (MAGA, CONRED etc.) at the local level and with other hierarchical levels of MAGA. This is an important result, because in other contexts drills revealed that information sharing and coordination between agencies is a crucial but complex and difficult task (Bharosa et al. 2010). In proactive drought management, intra-

institutional collaboration at different scales has been recognized as an important tool (see, for example, British Columbia Ministry of Environment 2016).

Third, the drill facilitated reflection and open discussion about the problems that became evident during the emergency drills. During a normal working routine, this reflection is not possible for regular staff. Reflection and the construction of organizational and individual knowledge is an important component of organizational learning processes that aim at changes in individuals and organizational behavior (Manz and Sims 1981).

Fourth, the drill led to concrete recommendations from the participants towards improving the implementation of the PIR. These recommendations flowed from a common experience created during the drill and were useful for individuals in a wide range of agencies and at different hierarchical levels. This finding confirms that debriefing the participants after the event allows drills to generate new and useful knowledge (Crookall and Thorngate, 2009).

The drills also revealed several obstacles that stand in the way of successfully implementing an emergency drill for institutional disaster preparedness. The most important obstacle we identified was the lack of any mechanism for accumulative learning. Although participants rated the drills as an excellent opportunity for reflection and capacity building, we did not see much evidence of institutional learning processes or behavioral change between the first and the second drills. MAGA did not take up any of the lessons learned or recommendations. Follow-up with key informants after the second drill suggested that the second drill too did not trigger any sustainable learning processes or changes in the institution. MAGA has a high staff turnover and a deficient information management infrastructure. These factors inhibit the successful use of emergency drills for institutional capacity building.

These observations mean that in this case a proper debriefing right after the event was not enough to ensure that experiential learning translates into behavioral change in the institution. To a certain degree, the long-term learning outcome of a drill or simulation exercise is not predictable and depends on a variety of factors (Hofstede et al. 2010). The institutional and cultural environment generally plays a significant role in how drills influence long-term learning in emergency response (cf. Pelling 2007, Hofstede et al. 2010). In Guatemala, the institutional weakness of the public sector creates a lack of continuity in political programs and personnel development. The second drill in 2015 took place a few months before the presidential elections in Guatemala. Thus, the possible changes in the personnel structure, in programs and in budget might be reflected in the self-assessment of the participants.

6. Conclusions

Our observations support the conclusion that emergency drills are a useful and effective instrument to evaluate the organizational capacity of public institutions to respond to emergencies caused by agro-climatic events. Specifically, emergency drills can be applied to evaluate institutional response to slow-onset events such as droughts.

Drills provided a secure setting for making problems tangible, to trigger reflections on institutional emergency response capabilities and for motivating staff and stakeholders to discuss solutions to the problems encountered. While these are valuable contributions, the drills were not transformative, in that they did not cause changes in MAGA's institutional behavior or protocols for

drought response. This is partly due to structural problems in the Guatemalan public sector related to the short political planning cycle, which makes substantial changes at the institutional level very difficult to implement.

While some challenges are specific to the Guatemalan setting, it is likely that the difficulty of transforming knowledge and experiential learning gained through drills into long-term behavioral changes at individual and organizational levels is a generic problem. Drills and simulations are valid tools for creating capacity and knowledge, but the institutional context strongly influences whether the drills can contribute to sustainable organizational learning that results in behavioral changes.

We recommend embedding drills that focus on drought in a broader strategy aimed at creating and improving the institutional capacity in disaster response. This should include creating improved protocols that give more attention to inter-sectoral linkages and training the technical staff properly to use the new protocols. Changes are needed to make it possible to retain trained personnel for longer periods. As this will take time, in the short term institutions need instruments to quickly train new personnel and ensure compliance with data collection standards. Digital media and tools can play an important role to achieve better training. The need for stronger inter-sectoral coordination implies that CONRED, the government institution responsible for inter-sectoral coordination of disaster response, exercises leadership in creating disaster response protocols and in improving institutional capabilities.

MAGA should undertake a capacity building process among its extension agents, accompanied by a process of standardizing steps for damage and loss evaluation and information gathering. CONRED and MAGA should consider emergency drills as a valid instrument to create the institutional capacity for adequate disaster response to slow-onset disasters and for fostering institutional learning, and should put in place the mechanisms to this end. Within such a wider strategy, drills would provide an important contribution towards integrated drought risk management.

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